AC 20.08.22 ITEM NO: 1.22.1

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for
Program: Bachelor of Science
Course: F.Y.B.SC.
Subject: Chemistry

Choice Based Credit System (CBCS)
with effect from
Academic Year 2022-2023

Semester-I

Course Code	Course Title	Credits	Lectures/ Week
KUSCH22101	**Paper I**	**2**	**3**

CO1	On completion of this topic on **Chemical Thermodynamics**, students will be able to understand the concept of of systems, bounderies, state functions, path functions and relations between heat energy and work. They understand the enthalpy of a system, heat capacity at constant volume and constant pressure and its uses. They able to calculate change in enthalpy and heat capacity through Kirchoff's law.
CO2	The student will able to define and calculate the number of molecules present in a given number of moles. They will able to define various terms of concentrations and formulae and able to calculate equivalent weight, normality, molarity, formality, molality, mole fraction of the solutions. They understand to write concentrations of solutions in weight percent, volume percent, or "weight/volume" percent and the concentration of solutions in ppm and ppb.
CO3	The student will able to understand the historical perspectives of atomic structure such as Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom and Structure of hydrogen atom. The student will understand Hydrogenic atoms and Simple principles of quantum mechanics. The student will also learn about Atomic orbitals, Hydrogenic energy levels, Shells, subshells and orbitals, Electron spin, Radial shapes of orbitals, Radial distribution function and Angular shapes of orbitals. They will also learn Many Electron Atoms, Penetration and shielding, Effective nuclear charge and Aufbau principle.
CO4	The student will understand Long form of Periodic Table, Classification for elements as main group, transition and inner transition elements; Periodicity in the following properties : Atomic and ionic size; electron gain enthalpy; ionization enthalpy, effective nuclear charge (Slater's rule); electronegativity ; Pauling, Mulliken and Alred Rochow electronegativities. The students will also able to solve Numerical problems.
CO5	The undergraduate students will understand the different aspects of IUPAC nomenclature of organic compounds. b. The learner will be able to draw the structures of organic compounds from their IUPAC names and vice versa.
CO6	The students will be able to explain the concept of hybridization. The students will be able to highlight the significant outcomes of hybridization. The student will able to predict the shapes of organic molecules on the basis of hybridization.
CO7	The student will be able to explain the fundamental concepts of an organic reaction mechanism. The students will be able to reason how the electronic effects affect the different properties of a molecule. The student will be able to explain the features of reactive intermediates. The student will be able to analyze the factors which are responsible for the stability of these intermediates.

Unit	Topics	No of Lectures
I	**1.1 Chemical Thermodynamics:** Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics First law of thermodynamics: concept of heat (q), work (w), internal energy (U), statement of first law, enthalpy, relation between heat capacities, sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) (Numericals expected) Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equation (Numericals expected) **1.2 Chemical Calculations:** Expressing concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio, volume ratio, weight to volume ratio, ppm, ppb, millimoles, milliequivalents (Numericals expected)	(10L) (5L)
II	**2.1 Atomic structure:** (Qualitative treatment only; it is expected that the learner knows the mathematical statements and understands their physical significance after completing this topic. No derivations of the mathematical equations required) a) Historical perspectives of the atomic structure; Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. b) Hydrogenic atoms: 1. Simple principles of quantum mechanics; 2. Atomic orbitals i) Hydrogenic energy levels ii) Shells, subshells and orbitals iii) Electron spin iv) Radial shapes of orbitals v) Radial distribution function vi) Angular shapes of orbitals. 3. Many Electron Atoms i) Penetration and shielding ii) Effective nuclear charge 4. Aufbau principle **2.2: Periodic Table and periodicity :** Long form of Periodic Table; Classification for elements as main group, transition and inner transition elements; Periodicity in the following properties : Atomic and ionic size; electron gain enthalpy; ionization enthalpy, effective nuclear charge (Slater's rule); electronegativity ; Pauling, Mulliken and Alred Rochow electronegativities (Numerical problems expected, wherever applicable.)	**(10L)** **(5L)**

III	**3. Basics of Organic Chemistry** 3.1 **Classification and Nomenclature of Organic Compounds:** Review of basic rules of IUPAC nomenclature. Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines;including their cyclic analogues. 3.2 **Bonding and Structure of organic compounds:** Hybridization: sp3, sp2, sp hybridization of carbon and nitrogen; sp3 and sp2 hybridizations of oxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide) Overlap of atomic orbitals: Overlaps of atomic orbitals to form sigma and pi bonds, shapes of organic molecules. Shapes of molecules; Influence of hybridization on bond properties (as applicable to ethane, ethene, ethyne) **3.3 Fundamentals of organic reaction mechanism:** **Electronic Effects:** Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strengths. **Bond fission:** Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophilicity and basicity; **Types (primary, secondary, tertiary, allyl, benzyl), shape and their relative stability of reactive intermediates:** Carbocations, Carbanions and Free radicals. **Introduction to types of organic reactions:** Addition, Elimination and Substitution reaction. (With one example of each)	**(5L)** **(4L)** **(6L)**

References:

Unit I:

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata Mc Graw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill (1994).
12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).

Unit II:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry
   Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

Unit III:

1. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
6. Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

Course Code	Course Title	Credits	Lectures/ Week
KUSCH22102	**Paper II**	**2**	**3**

Unit	Topics	No of Lectures
I	**1.1 Chemical Kinetics** Rate of reaction, rate constant, measurement of reaction rates, order and molecularity of reaction, integrated rate equation of first and second order reactions (with equal initial concentration of reactants) (Numericals expected) Determination of order of reaction by (a) Integration method (b) Graphical method (c) Ostwald's isolation method (d) Half time method (Numericals expected) **1.2 Liquid State** Surface tension: Introduction, methods of determination of surface tension by drop number method (Numericals expected) Viscosity: Introduction, coefficient of viscosity, relative viscosity,	(8L) (7L)

CO1	On completion of this topic on **Chemical Kinetics**, students will be able to understand the concept of Rate of chemical reaction and factors affecting the rate of reaction.They will be able to calculate and conclude about the order of given reaction. Different methods of determination of orders are studied and understood.
CO2	At the end of this course on **Liquid State**, the learner shall be able to identify the liquid state from other states of matter and differentiate between the various properties of matter particularly surface tension, viscosity,refractive index and polarizability. He will also know the experimental methods of determination of these properties, its instrumentation, the theory behind it and also the practical applications of the various properties. The learner will be able to understand r concept of liquid Crystal - its different types, its properties and applications.
CO3	The students will understand the comparative chemistry of main group elements by studying their metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period elements, allotropy, catenation and diagonal relationship.
CO4	They will also gain the knowledge of comparative chemistry of carbides, nitrides, oxides and hydrides of Group-I and Group-II elements along with some important compounds. They will study environmental aspects of compounds of carbon, nitrogen and sulphur.
CO5	Learners will be able to distinguish and draw different molecular projections and to interconvert them.
CO6	Learners would be able to identify and assign stereo descriptors using CIP rules.
CO7	Learners would understand the conformers of alkanes and their relative stabilities.

	specific viscosity, reduced viscosity, determination of viscosity by Ostwald viscometer (Numericals expected) Refractive index: Introduction, molar refraction and polarizability, determination of refractive index by Abbe's refractometer (Numericals expected) Liquid crystals: Introduction, classification and structure of thermotropic phases (Nematic,smectic and cholesteric phases), applications of liquid crystals.	
II	**2.0 Comparative chemistry of Main Group Elements** Metallic and non-metallic nature, oxidation states, electronegativity, anomalous behaviour of second period elements, allotropy, catenation, diagonal relationship. Comparative chemistry of carbides, nitrides, oxides and hydroxides of group I and group II elements. Some important compounds- $NaHCO_3$, Na_2CO_3, NaCl, NaOH, CaO, $CaCO_3$; oxides of carbon, oxides and oxyacids of sulphur and nitrogen with respect to environmental aspects.	(15L)
III	**3. Stereochemistry I** Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions ; Geometrical isomerism in alkene and cycloalkanes: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected). Relative and absolute configuration: D/L and R/S designations. Conformation analysis of alkanes (ethane, propane and n-butane); Relative stability with energy diagrams.	(15L)

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1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
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2.Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970

- Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
- Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962
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- Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
- Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

Course Code	Course Title	Credits	Lectures/ Week
KUSCHP22101	**Practical**	**2**	**6**

Course Outcome:

1	**Unit I: Physical Chemistry** 1. To prepare 0.1 N succinic acid and standardize the NaOH of two different concentrations. 2. To determine the rate constant for the hydrolysis of ester using HCl as catalyst 3. To determine enthalpy of dissolution of salt (like KNO_3).
2	**Unit II: Inorganic Chemistry** 1. Commercial analysis of (any two) a) Mineral acid b) Organic acid c) Salt of weak acid and strong base. 2. Titration using double indicator: analysis of solution of Na_2CO_3 and $NaHCO_3$. 3. Gravimetric analysis: a) To determine the percent purity of sample of $BaSO_4$ containing NH_4Cl b) To determine the percent purity of ZnO containing $ZnCO_3$.
3	**Unit III: Organic Chemistry** 1. Purification of any two organic compounds by recrystallization selecting suitable solvent. (Provide 1g.). Students are expected to report a) Solvent for recrystallization. b) Mass and the melting points of purified compound. Learners should calibrate thermometer before determining melting point. 2. Chromatography (Any one) a) Separation of a mixture of two sugars by ascending paper chromatography

CO1	By performing the experiments in this course the learner would be able to prepare solutions and standardise them.
CO2	Experimental study of kinetics of reactions would be learnt.
CO3	Learners would get acquainted with common titrimetric analytical methods to

	analyse commercial samples.
CO4	Gravimetric analysis of mixture of heat sensitive and heat stable samples would be learnt.
CO5	The learner would be able to purify common chemicals by crystallization and paper chromatography.

	b) Separation of a mixture of o-and p-nitrophenols by thin layer chromatography (TLC)

Reference Books :

Unit I: Physical Chemistry

1. Khosla B.D., Garg V.C. and Gulati A., Senior Practical Physical Chemistry, R. Chand and Co., New Delhi (2011).
2. Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).
3. Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).
4. Athawale V.D. and Mathur P., Experimental Physical Chemistry, New Age International, New Delhi (2001).

Unit II: Inorganic Chemistry

Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,*Pearson, 2009.

Unit III: Organic Chemistry

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996

Semester-II

Course Code	Course Title	Credits	Lectures / Week
KUSCH22201	**Paper I**	**2**	**3**

CO1	On completion of this topic on **Gaseous State**, the students will be ableto recapitulate the basic concepts such as gas laws, kinetic theory of gases etc. They will learn about the deviation of real gases from ideal behaviour, compressibility factor, Van der waal equation, Joule- Thomson effect- qualiative discussion and experimentation, Inversion temperature.
CO2	On completion of this topic on **Chemical Equilibria and Thermodynamic Parameters**, the student will know about reversible and irreversible reactions, dynamic equilibria and equilibrium constant(Kp and Kc).
CO3	The student will have holistic knowledge of the nature of compounds in chemistry and categorise them as Acid, Base or Neutral.
CO4	In chemistry of aliphatic hydrocarbons, the students will be able to learn the chemistry of C-C Sigma bonds and C-C pi bonds.
CO5	Preparation, chemical properties and reactions of alkanes, alkenes, alkynes.

Unit	Topics	No of Lectures
I	**1.1 Gaseous State**	(8L)

	Ideal gas laws, kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (qualitative discussion), ideal gases, real gases, compressibility factor, Boyle'stemperature (Numericals expected) Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals equation of state, Joule-Thomson effect: qualitative discussion and experimentation, inversion temperature. (Numericals expected) 1.3 **Chemical Equilibria and Thermodynamic Parameters** Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant, (Kc and Kp), relationship between Kc and Kp, Le Chatelier's principle, factors affecting chemical equilibrium (Numericals expected) Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy, thermodynamic derivation of equilibrium constant (Numericals expected)	(7L)
II	**2.1 Concept of Qualitative Analysis** a) Testing of Gaseous Evolutes, Role of Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with starch iodide, potassium dichromate, lead acetate, dimethylglyoxime and oxine reagents). b) Precipitation equilibria, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.) **2.2 Acid Base Theories** Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases. Applications of HSAB Applications of acid base chemistry in: i) Understanding organic reactions like Friedel Craft's (acylation/alkylation) reaction ii) Volumetric analysis with special reference to calculation of titration curve involving strong acid and strong base.	**(7L)** **(8L)**

III	**3. Chemistry of Aliphatic Hydrocarbons** **3.1 Carbon-Carbon sigma bonds** **Chemistry of alkanes:** Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation - relative reactivity and selectivity. **3.2 Carbon-Carbon pi bonds** **Formation of alkenes and alkynes by elimination reactions:** Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. **Reactions of alkenes:** Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction(catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2-and 1, 4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination using N-bromosuccinimide and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene. **Reactions of alkynes:** Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.	**(3L)** **(12)**

Reference books:

Unit – I

1) Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 10th Ed., Oxford University Press (2014).
2) Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
3) Keith J. Laidler & John H. Meiser, Physical Chemistry, 2nd Ed. (2004)
4) Puri B. R., Sharma L. R. & Pathania M. S. Principles of Physical Chemistry, Vishal Publishing Company, 2008
5) Ball, D. W. Physical Chemistry Thomson Press, India (2007).
6) Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
7) Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.,* Prentice-Hall (2012).
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9) Levine, I .N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010).

Unit II

1) Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2) Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
3) Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
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6) Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013
7) Paula Y Bruice, Organic Chemistry, 7th Ed, Pearson education, Asia.2014
8) Graham Solomon, Fryhle, Dnyder, Organic Chemistry, Wiley publication. 12 th Ed,2016
9) Bahl and Bahl, Advanced Organic chemistry by S. Chand publication.2010
10) Peter Sykes. Guidebook to the mechanism in Organic chemistry ,6th edition
11) D. Nasipuri. Stereochemistry of Organic Compounds, Principles and Applications, Second Edition

Course Code	Course Title	Credits	Lectures/ Week
KUSCH22202	**Paper II**	**2**	**3**

CO 1	The main objective of teaching this course is to make students understand about the concept of equilibrium in chemical reactions, pH and pH of buffer solution, Molecular Spectroscopy and Solid State.
CO 2	The students will study the concept of chemical bond and reactivity in which they understand the types of bonds along with comparison, polarizability, shapes of molecules, Lewis dot structure, VSEPR theory, isoelectronic principles, applications and limitations of VSEPR theory.
CO 3	The students will understand the importance of oxidation reduction chemistry by understanding the concept of reduction potentials, redox potentials along with applications of redox chemistry.
CO4	Conformational analysis of cycloalkanes would be learnt.
CO 5	Basics of aromatic compounds, Huckel's rule of aromaticity would be learnt. Learners would be able to write the mechanism of electrophilic aromatic substitution and understand Hammond's postulates.

Unit	**Topics**	No of Lectures
I	**1 Ionic Equilibria: (7L)** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di- and triprotic acid (exact treatment for monoprotic acid) Buffers: Introduction, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected) **1.2 Molecular Spectroscopy:** (4L) Electromagnetic radiation, electromagnetic spectrum, Planck's equation, interaction of electromagnetic radiation with matter: Absorption, emission, scattering, flourescence, electronic, vibrational and rotational transitions, Beer-Lambert's law (Numericals expected) **1.3 Solid State Chemistry:** (4L) Types of solids, crystal lattice, lattice points, unit cell, space lattice and lattice plane, laws of crystallography: Law of constancy of interfacial angle, law of symmetry and law of rational indices (Numericals expected)	(7L) (4L) (4L)
II	**2.1: Chemical Bond and Reactivity:** (7L) Types of chemical bond, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick Powell Theory, basic VSEPR theory for ABn type molecules with and without lone pair of	**(15L)**

			electrons, isoelectronic principles, applications and limitations of VSEPR theory. **2.2: Oxidation Reduction Chemistry:** (8L) a) Reduction potentials	
	Redox potentials: half reactions; balancing redox equations. c) Redox stability in water i) Latimer and Frost Diagrams ii) pH dependence of redox potentials. d) Applications of redox chemistry i) Extraction of elements: (example: isolation of copp			

	er by auto reduction) ii) Redox reagents in Volumetric analysis: a) I2; b) KMnO4 iii) Titration curves:i) single electron systems (example Ce(IV) against Fe(II)); and ii) Multi electron systems as in KMnO4 against Fe(II)	

	3.1 Stereochemistry-II: Cycloalkanes and Conformational Analysis: (5L) Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy. **3.2Aromatic Hydrocarbons**: (10L) Aroma	(15 L)

	ticity: Hückel's ruleanti-aromaticity, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft alkylation/acylation with their mechanism. , Hammond's postulate, Directing	

effects of the groups.	

Reference Books:

Unit I:

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemi

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2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
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11. Banwell

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Unit II:

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Course Code	Course Title	Credits	Lectures/ Week
KUSCHP22201	**Practical**	**2**	**6**

1	**Unit I: Physical Chemistry** 1. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH 2. To determine dissociation constant of weak acid (Ka) using Henderson's equation and the method of incomplete titration pHmetrically. 3. To verify Beer-Lambert's law, using KMnO4 solution by colorimetric method. 4. To standardize commercial sample of HCl using borax and to write material **safety data of the chemicals involved.**
2	**Unit II: Inorganic Chemistry** **1. Qualitative analysis: (at least 4 mixtures to be analyzed)** Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions. Cations (from amongst): Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+}, Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^{+},NH^{4+} Anions (From amongst): $CO3^{2-}$, S^{2-}, $SO3^{2-}$, $NO2^{-}$, $NO3^{-}$, Cl^{-}, Br^{-}, I^{-}, $SO4^{2-}$, $PO4^{3-}$ (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.) **2. Redox Titration:** To determine the percentage of copper(II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate **(iodometry titration)**
3	**Unit III: Organic Chemistry** **Characterization of organic compound containing C, H, (O), N, S, X elements.** (minimum 6 compounds)

<u>Reference Books :</u>

Unit I: Physical Chemistry

1. Khosla B.D., Garg V.C. and Gulati A., Senior Practical Physical Chemistry, R. Chand and Co., New Delhi (2011).
2. Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical

CO1	Learners would be able to revise and understand the chemical kinetics of saponification reaction.
CO2	Learners would be able to handle and use colourimetry and pH meters in the analysis.

CO3	Learners would be able to understand the MSDS of chemicals.
CO4	Learners would be able to identify common acidic and basic radicals in the given mixture.
CO5	Learners would be leart the Characterization of organic compounds containing C, H, (O), N, S, X elements.

Chemistry, 8th Ed., McGraw-Hill, New York (2003).
3. Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).
4. Athawale V.D. and Mathur P., Experimental Physical Chemistry, New Age International, New Delhi (2001).

Unit II: Inorganic Chemistry

Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.

Unit III: Organic Chemistry

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996

Evaluation Scheme for First Year (UG) under AUTONOMY

I. Internal Evaluation for Theory Courses – 40 Marks

(i) Continuous Internal Assessment 1 (Assignment-Tutorial/Industrial Visit) – 20 Marks

(ii) Continuous Internal Assessment 2 – 20 Marks (Class Test with Fill in the Blanks, True or False & Answer the following)

II. External Examination for Theory Courses – 60 Marks

Duration: 2 Hours
Theory question paper pattern:
All questions are compulsory.

Question paper pattern

Question	Based on	Options	Marks
Q.1	Unit I, II, III.	*MCQs 12 Out of 12*	12
Q.2	Unit I	*Any 03 out of 05*	12
Q.3	Unit II	*Any 03 out of 05*	12
Q.4	Unit III	*Any 03 out of 05*	12
Q.5	Unit I, II, III.	*Any 03 out of 05*	12

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. <u>Practical Examination</u>

- Each core subject course wise carries 50 Marks (30 marks External + 20 marks Internal)

Sr. No.	Undergraduate Practical Internal Evaluation:	Marks
1	Short Experiment/Field Trip/Excursion/Industrial Visit Report	15
2	Journal	5

Sr. No.	Undergraduate Practical External Evaluation:	Marks
1	Experiment/s	25
2	Viva	5

- Duration: 2 Hours for each practical course.
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam